CLAIMS

1. A mixture for etching a dielectric material in a layered substrate, the mixture comprising:

a fluorocarbon; and

a fluorine-containing oxidizer selected from the group consisting of a hypofluorite, a fluoroperoxide, a fluorotrioxide, and combinations thereof.

2. The mixture of claim 1 further comprising an inert diluent gas.

3. The mixture of claim 2 wherein the inert diluent gas is at least one selected from the group consisting of argon, neon, xenon, helium, nitrogen, krypton, and combinations thereof.

4. The mixture of claim 2 wherein the mixture comprises from 0.1 to 99 % by volume of the inert diluent gas.

5. The mixture of claim 1 wherein the fluorocarbon is at least one selected from the group consisting of perfluorocarbon, hydrofluorocarbon, oxyhydrofluorocarbon, oxyfluorocarbon, and combinations thereof.

6. The mixture of claim 5 wherein the fluorocarbon is at least one perfluorocarbon selected from the group consisting of tetrafluoromethane, trifluoromethane, octafluorocyclobutane, octafluorocyclopentene, hexafluoro-1,3-butadiene, and combinations thereof.

7. The mixture of claim 6 wherein the perfluorocarbon is hexafluoro-1,3-butadiene.

8. The mixture of claim 5 wherein the fluorocarbon is at least one hydrofluorocarbon.

9. The mixture of claim 9 wherein the fluorocarbon is at least one oxyhydrofluorocarbon.

10. The mixture of claim 5 wherein the oxyhydrofluorocarbon is at least one selected from the group consisting of perfluorocyclopentene oxide, hexafluoro-cyclobutanone, hexafluorodihydrofuran, hexafluorobutadiene epoxide, tetrafluorocyclobutanedione perfluorotetrahydrofuran (C_4F_8O), hexafluoropropylene oxide (C_3F_6O), perfluoromethylvinyl ether (C_3F_6O), and combinations thereof.

11. The mixture of claim 1 wherein the fluorine-containing oxidizer is a hypofluorite having the formula $C_xH_yF_z(OF)_nO_m$ wherein x is a number ranging from 0 to 8, y is a number ranging from 0 to 17, z is a number ranging from 0 to 17, n is 1 or 2, and m is 0, 1, or 2.

12. The mixture of claim 1 wherein the fluorine-containing oxidizer is a fluoroperoxide selected from the group consisting of difluoro-peroxide, fluoro-trifluoromethyl-peroxide, bis-trifluoromethyl peroxide, pentafluoroethyl-trifluoromethyl-peroxide, bis-pentafluoroethyl-peroxide, difluorodioxirane, bis-trifluoromethyl peroxydicarbonate, fluoroformyl trifluoromethyl peroxide, bis-fluoroformyl-peroxide, and combinations thereof.

13. The mixture of claim 1 wherein the fluorine-containing oxidizer is a fluorotrioxide selected from the group consisting of bis-trifluoromethyl-trioxide, fluoro-trifluoromethyl-trioxide, fluoroformyl trifluoromethyl-trioxide, and combinations thereof.

14. The mixture of claim 1 wherein a ratio by volume of the fluorine-containing oxidizer to the fluorocarbon is from 0.1:1 to 20:1.

15. The mixture of claim 1 wherein the mixture comprises 1 to 99% by volume of the fluorine-containing oxidizer.

16. The mixture of claim 1 wherein the mixture comprises from 1 to 99% by volume of the fluorocarbon.

17. The mixture of claim 1 wherein the dielectric material is at least one selected from the group consisting of silicon, silicon-containing compositions, silicon dioxide (SiO_2), undoped silicon glass (USG), doped silica glass, silicon and nitrogen containing materials, organosilicate glass (OSG), organofluoro-silicate glass (OFSG), low dielectric constant materials, polymeric materials, porous low dielectric constant materials, and combinations thereof.

18. A mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a hypofluorite.

19. A mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a fluoroperoxide.

20. A mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a fluorotrioxide.

21. A method for the removal of a portion of a dielectric material from a layered substrate, the method comprising:

placing the layered substrate within a reaction chamber;

providing a gas mixture comprising a fluorocarbon gas and an oxidizer gas selected from the group consisting of a hypofluorite, a fluoroperoxide, a fluorotrioxide, and combinations thereof;

applying energy to the gas mixture to form active species; and

contacting the layered substrate with the active species wherein the active species at least partially react with and remove the portion of the dielectric material.

22. The method of claim 21 wherein the gas mixture has a pressure ranging from 0.1 to 10,000 mTorr.

23. The method of claim 21 wherein the flow rate of the gas mixture ranges from 10 to 50,000 standard cubic centimeters per minute (sccm).

24. The method of claim 21 wherein the gas mixture is provided through at least one method selected from the group consisting of conventional cylinders, safe delivery systems, vacuum delivery systems, solid-based generators, liquid-based generators, point of use generators, and combinations thereof.

25. The method of claim 21 wherein the energy source in the applying step is at least one selected from the group consisting of α-particles, β-particles, γ-rays, x-rays, high energy electron, electron beam sources, ultraviolet light, visible light, infrared light, microwave, radio-frequency wave, thermal energy, RF discharge, DC discharge, arc discharge, corona discharge, sonic energy, ultrasonic energy, megasonic energy, and combinations thereof.

26. A method for etching at least a portion of a dielectric material from a layered substrate comprising: contacting the layered substrate with active species of a mixture comprising a fluorocarbon selected from the group consisting of a perfluorocarbon, a hydrofluorocarbon, an oxyfluorocarbon, a oxyhydrofluorocarbon, and combinations thereof, and a fluorine-containing oxidizer selected from the group consisting of a hypofluorite, a fluoroperoxide, a fluorotrioxide, and combinations thereof wherein the active species of the mixture at least partially react with and remove the at least a portion of the dielectric material.